26–27th, a tornado crossed Lapeer county, moving in a southwest direction from Marathon to Almont and touching the earth every mile or two. The track was nowhere more than eighty rods wide, in some places only ten rods. The limits of its track were very sharply defined. In some cases the débris was carried four miles.

NAVIGATION.

STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for May, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, May, 1886.

[*Expressed in feet and tenths.*]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, Louisiana	29.9	1	18.0	31	5.2	12.8
Arkansas River:						
Fort Smith, Arkansas	22.0	1	9.8	30, 31	3.3	6.5
Little Rock, Arkansas	23.0	2	11.5	30, 31	3.6	7.9
Missouri River:						
Yankton, Dakota	24.0	15, 16	16.9	7	14.7	2.2
Omaha, Nebraska	18.0	6	9.8	26 to 31	8.2	1.6
Leavenworth, Kansas	20.0	7	11.9	31	9.2	2.7
Mississippi River:						
Saint Paul, Minnesota	14.5	3, 4, 5	8.0	30, 31	4.3	3.7
La Crosse, Wisconsin	24.0	1	10.2	31	6.5	3.7
Dubuque, Iowa	16.0	.....	.....	.....	.....	.....
Davenport, Iowa	15.0	2	12.7	31	6.5	6.2
Keokuk, Iowa	14.0	6	16.0	31	8.1	7.9
Saint Louis, Missouri	32.0	13	27.0	31	18.0	9.0
Cairo, Illinois	40.0	17, 18	39.8	6	24.7	15.1
Memphis, Tennessee	34.0	1	34.6	9	22.8	11.8
Vicksburg, Mississippi	41.0	7, 8, 9	44.2	31	41.9	2.3
New Orleans, Louisiana	13.0	14, 15, 19, 20, 23, 24, 25, 27 to 31	14.3	1	13.9	0.4
Ohio River:						
Pittsburg, Pennsylvania	22.0	15	13.0	31	2.4	10.6
Cincinnati, Ohio	50.0	15	37.0	31	12.8	24.2
Louisville, Kentucky	25.0	16	14.7	2	6.5	8.2
Cumberland River:						
Nashville, Tennessee	40.0	13	28.7	30	5.0	23.7
Tennessee River:						
Chattanooga, Tennessee	33.0	12	10.8	19	5.7	5.1
Monongahela River:						
Pittsburg, Pennsylvania	29.0	15	13.0	31	2.4	10.6
Savannah River:						
Augusta, Georgia	32.0	21	32.5	16	7.7	24.8
Mobile River:						
Mobile, Alabama	.....	19	18.7	26	16.8	1.9
Sacramento River:						
Red Bluff, California	.....	8	7.0	31	3.2	3.8
Sacramento, California	.....	1	23.0	30, 31	21.0	2.0
Willamette River:						
Portland, Oregon	.....	31	17.4	7	7.3	10.1
Colorado River:						
Yuma, Arizona	.....	31	24.5	4, 5, 6	18.5	6.0

The Mississippi River was at the danger point, or above it, at New Orleans, Louisiana, during the last half of the month; from New Orleans northward the highest stage of water occurred at Vicksburg, Mississippi, on the 7th, 8th, and 9th, and at Memphis, Tennessee, on the 1st.

Owing to the drought which prevailed in the Red River valley the Red River was very low during the entire month, reaching its lowest point on the 31st.

The Ohio River was highest at all points about the middle of the month and lowest on the 31st.

The Missouri River reached its lowest point on the 31st.

ICE IN RIVERS AND HARBORS.

Port Huron, Michigan: small quantities of ice were seen floating down the Saint Clair River on the 1st and 2d.

Duluth, Minnesota: during the night of the 3–4th the wind blew briskly from the northwest, driving the ice from the north shore; heavy rain followed, causing a break in the ice, which was taken advantage of by many boats outside. The steamer "Campana" arrived at noon, being the first arrival of the season.

Fort Benton, Montana: the steamer "Rosebud" arrived from Bismarck on the 15th, being the first vessel of the season to arrive here.

Saint Vincent, Minnesota: the steamer "Pluck" from Fargo, Dakota, arrived on the 28th, being the first boat reaching here since the opening of navigation.

FLOODS.

San Antonio, Texas: a heavy thunder storm occurred at this place during the afternoon of the 2d, 2.30 inches of rain falling in less than two hours. The storm was quite severe in the town, overflowing the irrigating ditches and the San Antonio River, which rose five feet in less than three hours, carrying away fences and destroying vegetable gardens, entailing a loss of $20,000. Excepting the damage caused by the flood this rain was of great benefit to farmers and stockmen, as very little rain had fallen during the two preceding months.

Lead Hill, Arkansas: reports from Ozark county, Missouri, say: on the night of the 5–6th the Little North Fork Creek, in this county, overflowed its banks, and destroyed considerable farm property. Beaver Creek, in Douglas and Taney counties, Missouri, also overflowed at the same time, and did much damage to farm land.

Springfield, Missouri: a very heavy rainfall prevailed at this place and over the adjacent country during the 5th and 6th, 6.60 inches of rain falling in twenty-seven hours, doing a large amount of damage to property both in town and over the surrounding country. The rain was preceded by hail, which fell to a considerable depth in about fifteen minutes, many of the hailstones being from one-half to two inches in diameter. All the creeks and their branches became much swollen, tearing away fences and inundating bottom lands. Jordan Creek, which runs directly through this city, rose higher than for many years, overflowing the lowland and driving thirty or forty families from their homes. Some of the women and children were carried out on horseback and on men's shoulders to the higher ground to escape drowning, the water in places rising into the second stories of the dwellings. Three of the city's wooden bridges were washed away, and the basements of a number of business houses were filled with water. Some of the smaller dwelling houses were carried from their foundations. A large amount of lumber was lost. Half a mile of the Gulf Railway track, within the city limits, was completely submerged, interrupting the passage of trains. The damage in the city and surrounding country was estimated at $115,000.

Emporia, Kansas: a heavy fall of rain, which is described by those who saw it as a "waterspout," passed down Jacobs' creek, fourteen miles southwest of this place, on the 6th. Five persons who were traveling in a wagon were overtaken by the flood and the vehicle was swept away, two of its occupants being drowned. The storm between Emporia and Florence was very severe, hailstones of large size falling. An eastern bound passenger train on the Santa Fé railroad had many windows broken by the hail.

Fort Scott, Bourbon county, Kansas: a destructive rainstorm occurred at this place about noon on the 6th. During the storm an ice dam broke and the water, heretofore held back by the dam, uniting with the already swollen stream, rushed down the valley, destroying a house and drowning one of its occupants.

Nevada, Vernon county, Missouri: it is estimated that the damage done to buildings and culverts by the heavy rainstorm of the 6th will reach $10,000. The Missouri Pacific Railroad track was washed out in several places between this place and Fort Scott, delaying trains for twenty-four hours. Crops were seriously damaged.

Dale Enterprise, Rockingham county, Virginia: the heavy rainfall of the month did great damage to county roads and railway tracks. Plowed fields were badly washed. The forks of the Shenandoah River were, on the 8th, as high as during the flood of November 24th, 1877.

Pittsburg, Pennsylvania: owing to heavy rainfall at the headwaters the Monongahela River rose nine feet in twenty-four hours on the 8th and 9th. A fleet of coal barges broke from its wharf and was carried down the river, detaching several other fleets with which it came in contact. Thirty-three barges were sunk or damaged, entailing a loss of about $100,000.

Jacksonborough, Butler county, Ohio: on the 12th heavy rain did considerable damage to roads and bridges. Cornfields were overflowed, necessitating replanting.

Xenia, Ohio: about 8 p. m. of the 12th this place was the scene of an unusually disastrous thunder-storm and flood. The rain fell in sheets while the lightning was incessant. Shawnee Creek, heretofore a small stream, suddenly overflowed its banks and in the darkness drowned twenty-nine persons and injured about one hundred, besides destroying much property. The destruction to property in this town amounted to $75,000, while the railroads suffered much more. The bridges between here and Spring Valley, on the Little Miami Railroad, and about five miles of track were carried away. The Dayton and Ironton Railroad, between here and Trebeins, was washed out badly. One of the causes of the destruction in Xenia was a small culvert under the Columbus and Zenia Railroad, just east of the Wilmington pike. Being insufficient to let the water through, the flood rose to the top of the road, forming a lake, which suddenly broke the embankment, and letting the water out with a rush, it came down into the town in a body ten to fifteen feet high, carrying everything before it.

Piqua, Miama county, Ohio: heavy rain fell continuously during the 12th, causing the Big Miami River to rise rapidly and flood the lower part of the town.

Marion, Grant county, Indiana: the growing crops, especially corn and wheat, sustained great damage by the overflow of the Mississenewa River, caused by the unusually heavy rains of the 11th, 12th, and 13th. Hundreds of fields were submerged.

Columbus, Ohio: at 10.10 p. m. of the 12th a very heavy rain set in, accompanied by vivid and incessant lightning, which continued until a late hour at night. The rainfall was very heavy, 1.93 inches falling in a few hours. Sewers were insufficient to carry off the volume of water, and many cellars in the lower part of the city were flooded and their contents damaged.

Dayton, Montgomery county, Ohio: on the night of the 12–13th a very damaging wind and rain storm occurred in this city and the adjacent county. This storm was followed by a destructive flood. In the city the damage from flood was great; whole sections of the town were submerged, and the people compelled to leave their homes for safety. Eight houses along Wolf Creek, in the western part of the city, were carried away, together with their contents. A bridge across the same creek was carried down the stream, as was also the Pan Handle bridge, about a mile from Dayton. The Miami River presented to view a rapidly flowing volume of water, bearing on its surface houses, barns, sheds, cattle, and driftwood of fences and trees. The canal bank south of the city was broken and the adjoining fields were flooded. The damage to crops and fruit in this county was quite extensive, and much of the land about Dayton was completely inundated. The greatest loss fell on farmers, as numerous farms that were situated on hillsides had the soil washed away as deep as it was plowed. In this county alone ten thousand acres of corn fields had the newly planted corn washed out; the same damage was suffered by tobacco and potato fields. The total loss is estimated at nearly $1,000,000.

Eaton, Preble county, Ohio: a destructive hail and rain storm occurred here on the afternoon of the 12th and night of the 12–13th. The damage to bridges over Seven Mile Run and other streams was considerable. A bridge immediately west of the town, that had stood for sixty years, was swept away, and in the eastern part of the county several houses and barns were destroyed. Much damage was done to other farm property, including crops.

New Straitsville, Perry county, Ohio: during the night of the 12–13th a severe rain and wind storm occurred at this place. A number of houses were flooded and trees uprooted by the wind. Miners near Shawnee were obliged to cease operations on account of high water. The New York Furnace dams gave way, flooding the furnace and otherwise injuring property to such an extent as to require two weeks in which to repair damages.

Springfield, Ohio: the storm of the night of the 12–13th was very destructive in Springfield and the adjacent country. East High street bridge, recently constructed at a cost of $6,000, was undermined and thrown down. Hundreds of families in the eastern and southern parts of the town were driven from their houses by the flood. Much property was destroyed in that quarter of the city. A bridge over the east fork of the Little Miami River, near Harmony, was carried down the stream, destroying an iron bridge with which it came in contact two miles below.

Connersville, Fayette county, Indiana: the White Water River was reported higher on the morning of the 13th than it had been for twenty years. The levees along the river were all broken and the feeder dam at Lockport carried away, cutting off the town's water supply. The White Water Railroad bridge at Hagerstown was partially destroyed and the railroad undermined at several other places, stopping all travel. Wheat, corn, and other crops were washed out or buried in the sediment left by the retiring water. Thirty head of cattle were carried down the river and drowned.

Saint Louis, Missouri: an unusually heavy rain and wind storm visited this city at 6 p. m. of the 14th. The storm came from the southwest and lasted only one hour. Over two thousand buildings, located on streets in which the sewers had become choked, were flooded with from two to four feet of water. The streets, for blocks in all directions, were submerged, and all street-car traffic was suspended. At south Saint Louis the damage was heavy, Kosciusko, Broadway, Jackson, and Dakota streets being flooded for miles, and the residents forced to leave their homes for safety. The southwestern and western parts of the city also suffered from water; at Lafayette and Ohio avenue the flood was ten feet deep. This freshet arose very suddenly, the flooded portions of the city having been perfectly dry two hours before the time of maximum height of the flood.

Charlotte, North Carolina: unusually heavy rain fell over a district embracing the Carolinas on the 18th, 19th, and 20th, the total precipitation for those days, at this place, being 8.25 inches; streams were very much swollen and great damage from floods was reported. Three washouts occurred on the Charlotte, Columbia, and Augusta Railroad, and other railroads suffered severe injury. A trestle over Coddle Creek was washed away and one span of the bridge, one hundred and fifty feet long, over the Yadkin River was destroyed. The greatest loss was sustained by farmers, their crops being injured and stock drowned.

Spartanburg, Spartanburg county, South Carolina: the heavy rainfall of the 18th, 19th, and 20th, 9.40 inches, caused destructive floods on bottom lands, and did much damage to crops.

Johnsonville, Humphreys county, Tennessee: during the afternoon of the 19th a very heavy rain storm, accompanied by high wind, occurred, inflicting considerable damage on farmers.

Columbia, South Carolina: during the 20th a heavy rain storm visited this city and the upper part of the state, causing freshets which destroyed considerable property. Many of the railroads entering the city were rendered impassable for several days, and the water works were swept away. The Columbia Canal, which the state had been building for five years, was in some places completely destroyed. Considerable cotton land was overflowed, and the loss of cattle was very great; one cattle raiser alone is reported to have lost $10,000 worth of live stock. The factories in the city depending upon water power were obliged to suspend operations on account of the high water in the Congaree River.

Augusta, Georgia: in consequence of the heavy rains of the 18th and 19th, the Savannah River was very high on the 20th and 21st, reaching, at 9 p. m. of the 20th, a depth of thirty-two feet above low-water mark, exceeding the flood of April 1, 1886, by two feet, and being higher than any flood since the freshet

of 1865. All factories and mills in the western part of the city were compelled to suspend work. Farm property suffered great damage; hay, cattle, and fences were carried away and growing crops washed out or buried in the sediment left by the water. It is estimated that the loss to planters occupying the bottom lands between here and New Savannah will exceed $50,000.

Charleston, South Carolina: on the 20th and 21st destructive freshets occurred in all the streams in the northern and northeastern parts of the state. The Pedee River was very high, overflowing and completely destroying crops in the lowlands. Considerable damage was also done to railroads and crops in the northern and western parts of the state.

Abingdon, Washington county, Virginia: a very heavy fall of rain, which is described as a "water-spout," occurred here on the 27th. Farm property was injured and one person drowned.

HIGH TIDES.

Cape Henry, Virginia, 1st.
Smithville, North Carolina, 29th, 30th.
Cedar Keys, Florida, 6th.

LOW TIDES.

Albany, New York, 27th: as a result of ebb tide in the river the water was quite low and a number of vessels were grounded.

Low tides were also reported from—
Indianola, Texas, 1st, 2d, 3d, 6th, 16th, 20th, 27th, 28th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for May, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 75.85 per cent. The percentages for the four elements are: Weather, 78.21; wind, 76.56; temperature, 72.27; barometer, 75.53 per cent. The percentages for the several states are: Maine, 72.51; New Hampshire, 74.57; Vermont, 73.97; Massachusetts, 74.74; Rhode Island, 70.43; Connecticut, 69.66; New York, 74.65; Pennsylvania, 72.95; New Jersey, 77.81; Delaware, 77.26; Maryland, 76.84; Virginia, 78.08; North Carolina, 79.64; South Carolina, 85.09; Georgia, 85.23; Florida, 80.98; Alabama, 84.73; Mississippi, 84.50; Louisiana, 86.78; Texas, 84.42; Tennessee, 74.19; Kentucky, 77.69; Ohio, 74.00; West Virginia, 69.02; Indiana, 77.32; Illinois, 74.82; Michigan, 73.30; Wisconsin, 70.14; Minnesota, 67.03; Iowa, 69.62; Nebraska, 65.16; Kansas, 68.62; Missouri, 74.01; Arkansas, 79.48; Colorado, 84.44; East Dakota, 65.15. There were twenty-one omissions to predict, out of 9,764, or 0.22 per cent. Of the 9,743 predictions that have been made, seven hundred and fifty-six, or 7.76 per cent., are considered to have entirely failed; five hundred and forty-eight, or 5.62 per cent., were one-fourth verified; 1,730, or 17.76 per cent., were one-half verified; 1,283, or 13.17 per cent., were three-fourths verified; 5,426, or 55.69 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During May, 1886, there were fifty-two signals of various kinds displayed, of which number, twenty-four, or 46.15 per cent., were fully justified both as to the direction and velocities of the winds. Of the signals above mentioned twelve were ordered for northwesterly winds; of these, eight, or 66.67 per cent. were justified both as to direction and velocity, and nine, or 75.0 per cent., were justified as to velocity only. Seven signals were ordered for southwesterly winds, and two, or 28.57 per cent., were justified. Nine signals were ordered for northeasterly winds, and eight, or 88.88 per cent., were justified. Of fifteen cautionary signals ordered, without specifying the direction, none were justified. Nine "on-shore" signals were ordered at lake stations, and six, or 66.67 per cent., were justified.

In fifty-four cases winds occurred which would have justified the display of signals.

COLD-WAVE SIGNALS.

No cold-wave signals were ordered during May.

RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for May, 1886, states:

The verifications of predictions for the whole area was 94 per cent. for temperature, and 90 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; and the cities of Milledgeville, Georgia, and Talladega, Alabama.

Prof. Winslow Upton, director of the "New England Meteorological Society," in the report for May, 1886, states:

The verification of weather signals at New Haven was 71 per cent. for temperature, 83.9 for weather; at eighteen other stations reporting to the Secretary, 88.5 for temperature, 79.5 for weather. Local predictions made at Blue Hill gave 63 per cent. for rains, 81 for weather.

J. D. Plunkett, M. D., president of the "Tennessee State Board of Health," in the report for May, 1886, makes the percentage of verifications for temperature in the state 89.5, and weather, 84.4.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The brilliant auroral display of the 8–9th was extensively observed, it having been reported from stations on the north Pacific coast, in the northern plateau, northern slope, and from various stations in that part of the country from 100° W. eastward to the Atlantic ocean, and lying north of the thirty-eighth parallel. This aurora was observed as far south as Statesville, North Carolina, and by a vessel on the Atlantic in N. 40° 24′, W. 60° 40′.

Displays were reported during the month as follows:

Mackinaw City, Michigan: an auroral arch of 15° altitude and 80° azimuth, with an occasional streamer, was observed during the night of the 1st and 2d. A faint auroral light of 15° altitude and 45° azimuth, was also seen on the 20th, beginning at 10.30 p. m. and continuing until after midnight.

Tatoosh Island, Washington Territory: on the 3d an aurora was observed at 8 p. m., consisting of a diffuse white light extending from 3° east of, to 24° west of north.

Yankton, Dakota: an aurora was visible from 10.00 to 11.50 p. m. of the 8th, consisting of an arch of white light with streamers reaching, at times, within 30° of the zenith.

Valentine, Nebraska: an auroral arch was visible from 9.30 p. m. of the 8th until after midnight of the 9th. The centre of the aurora was about 15° east of north and extended over 30° of azimuth. At 10.20 p. m. streamers extending almost to the zenith were observed; at times they extended several degrees below the arch. The maximum brilliancy occurred at 10.30 p. m.

Saint Vincent, Minnesota: on the 8th at 9.50 p. m., a remarkably brilliant auroral display began. When first observed it consisted of a single streamer having a width varying from 4° to 8°, which spanned the sky from east to west, at the same time having a preceptible movement toward the west. At 10 p. m. the aurora had changed in shape, and appeared as a perfect corona; later it appeared as a diffuse, whitish light in the west, while in the east it presented a deep orange tint and had a very active undulatory motion, constantly changing in form. At 10.20 p. m. a beautiful and well defined "auroral curtain" was formed in the east, which appeared as though hung in loops or folds, owing to the peculiar arrangement of the beams; this formation lasted about five minutes. At 11.40 p. m. it appeared in the form of numerous broad streams of white light moving rapidly toward the zenith. At 12.40 a. m. of the 9th, a dark bank was observed on the northern horizon and the light above it was more brilliant, while in the east the aurora had almost disappeared. The phenomenon continued until 2.10 a. m. The Signal Service observer at this station